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Short Communication

Dietary composition of *Oxyrhopus trigeminus* in the Brazilian semiarid: new records, a literature review, and an incidental case of plastic ingestion

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Abstract

The Caatinga, the largest seasonal dry tropical forest in South America, has been experiencing significant environmental disturbances due to deforestation, agricultural expansion, and increasing energy infrastructure installation. These changes can impact local biodiversity, particularly aspects of natural history, such as trophic ecology. This study investigates the diet of *Oxyrhopus trigeminus* (the Brazilian false coral snake) in the Caatinga biome of northeastern Brazil, combining a literature review and an analysis of stomach and intestinal contents of 48 specimens. Our findings confirm that the species primarily preys on lizards, particularly *Tropidurus hispidus* and *Ameivula ocellifera*, which are among the most abundant lizards in the semiarid region of the Caatinga. Additionally, we report for the first time the presence of *Micrablepharus maximiliani* in the diet of *O. trigeminus*. The study also documents the ingestion of plastic fragments, highlighting a growing concern regarding pollution in natural environments and its potential effects on trophic interactions. As part of the study, weight and morphometric data were collected from all examined specimens; although not the primary focus, these measurements are included as supplementary information, given their potential value for future comparative and ecological analyses. Given the increasing habitat alterations in the Caatinga, changes in prey availability may potentially affect the dietary patterns of *Oxyrhopus trigeminus* and other snake species. Despite the limited sample size, our findings highlight the importance of baseline dietary data and underscore the need for long-term monitoring to better understand how environmental changes may influence predator-prey dynamics and the ecological stability of semiarid ecosystems.

Key words: Brazilian false coral snake, Brazilian semiarid, neotropical snakes, predator-prey relationships

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Introduction

Oxyrhopus trigeminus, commonly known as the Brazilian false coral snake, is a species in the family Dipsadidae found in all regions of Brazil (Guedes et al. 2023). It is widely distributed across various biomes, including the Caatinga (Guedes et al. 2014), and is relatively abundant in the semiarid areas of the state of Rio Grande do Norte (Caldas et al. 2016; Calixto and Morato 2017; Marques et al. 2021).

This terrestrial species is crepuscular and nocturnal (Vitt and Vangilder 1983; Mesquita et al. 2013; Guedes et al. 2014) and typically forages for small vertebrates that inhabit the ground or low-lying vegetation. While its activity patterns may influence the types of prey it encounters, there is no evidence that its crepuscular and nocturnal behavior is directly linked to higher predation efficiency. *O. trigeminus* subdues its prey through constriction, and its rear-fanged dentition may assist in immobilizing small vertebrates during ingestion by delivering venom (Vanzolini et al. 1980).

Snakes play fundamental ecological roles in the ecosystems they inhabit, functioning as key predators in various food webs (Rodrigues 2003). The generalist nature of *O. trigeminus* refers specifically to its feeding behavior, allowing the species to consume a wide range of prey types depending on their availability in the environment (Shine et al. 1998; Coelho et al. 2019). In the Caatinga, its diet primarily consists of lizards, such as *Tropidurus hispidus* and *Ameivula ocellifera*, which are relatively abundant in the semiarid region (Vitt and Vangilder 1983; Mesquita et al. 2013). In more humid biomes, such as the Atlantic Forest, its prey diversity may include small mammals and birds, reflecting the species' dietary plasticity (Alencar et al. 2012).

The Caatinga is home to one of the richest levels of biodiversity among the world's arid and semiarid regions (Silva et al. 2017a), yet it is among the most threatened biomes in Brazil due to unsustainable land use practices (Araujo et al. 2023). Its semiarid climate is characterized by high temperatures and prolonged droughts, with rainfall concentrated between January and July (Ab'Saber 1974).

Analysis of consumed prey offers insights into both the species' diet and the structure of its prey communities with which *O. trigeminus* interacts (Martins and Oliveira 1998). Studies exploring the ecological roles of species across ecosystems—whether as predator or prey—are fundamentally important (Alencar et al. 2012). Such knowledge aids in understanding dietary requirements and the predominance of certain prey items over others (Martins and Oliveira 1998). The broad distribution of *O. trigeminus* across different Brazilian biomes suggests that the feeding patterns observed in the semiarid region can be contrasted with those in other habitats, revealing specific ecological adaptations to different environmental conditions.

The present study aimed to (1) conduct a literature review on the diet of *O. trigeminus* and (2) provide new data on the dietary composition of the species based on specimens collected in Caatinga areas in the state of Rio Grande do Norte, Brazil. Additionally, morphometric and weight data were recorded for future ecological analyses. These findings contribute to a better understanding of the trophic interactions and ecological adaptations of *O. trigeminus* in the Brazilian semiarid region.

Materials and methods

Literature review

To refine the search and limit the results to the target species, the scientific name "*Oxyrhopus trigeminus*" was inserted within quotation marks across all platforms. This strategy was adopted to avoid retrieving results related to

congeners (other *Oxyrhopus* species). The additional terms (i.e., diet, prey, predation, and their Portuguese and Spanish equivalents) were not placed within quotation marks, allowing the platforms to retrieve results where these keywords appear in various contexts related to the species. No further narrowing filters (e.g., publication date, language, or document type) were applied, as the total number of publications retrieved was relatively low. Consequently, all retrieved records were manually screened to identify studies or scientific notes containing relevant dietary or predation data for *O. trigeminus*. These searches were conducted using Google Scholar, Scopus, and SciELO.

Fieldwork and specimen screening

Among them, 41 specimens were donated to the Laboratório de Ecologia e Conservação da Fauna Silvestre (EcoFauna) at the Federal Rural University of the Semi-Arid (UFERSA) between February 2020 and May 2024 by companies involved in vegetation clearance for the installation of wind farms, photovoltaic plants, and electrical transmission networks in the state of Rio Grande do Norte. The animals donated by these companies died during vegetation suppression activities and were collected at the time of death, then refrigerated or frozen. Although some specimens were not physically intact due to mutilation during these activities, they were still considered fresh.

The remaining seven specimens were roadkills collected during road monitoring conducted as part of a laboratory project under collection permit number 40.620, issued by the Biodiversity Information and Authorization System (Sisbio) of the Brazilian Ministry of the Environment, valid from September 2014 to October 2024. For road-killed animals, only those in a fresh state were considered, specifically those found within one hour after death, before the onset of livor mortis. This condition was assessed based on the presence of moist open lesions, absence of gas bloating, and lack of a putrid odor. Additionally, the animals needed to retain physical integrity, i.e., they could not be severely crushed or flattened. Finally, any specimens that presented cadaveric alterations capable of interfering with measurements were excluded from the study. Collection sites for each specimen are presented in Fig. 1 below.

Upon arrival at the laboratory, the snakes were screened to obtain morphometric data. Snout-vent length (SVL) and tail length (TL) were measured using a measuring tape with 1 mm accuracy. The remaining measurements were taken using a digital caliper with 0.05 mm accuracy. The measurements included SVL, TL, head width (HW), internarial distance (IND), interorbital distance (IOD), eye diameter (ED), eye-nostril distance (END), upper eyelid width (UEW), and nostril-snout distance (NSD) (see Boback 2006; França et al. 2008). Specimens with fragmented carcasses, damaged heads, or other missing parts did not have all morphometric data recorded. Body mass was measured using a BL-320AB precision digital scale (accuracy: 0.0001 g).

All specimens were dissected, and their gastrointestinal contents were removed and identified to the lowest possible taxonomic level, with ingestion position recorded.

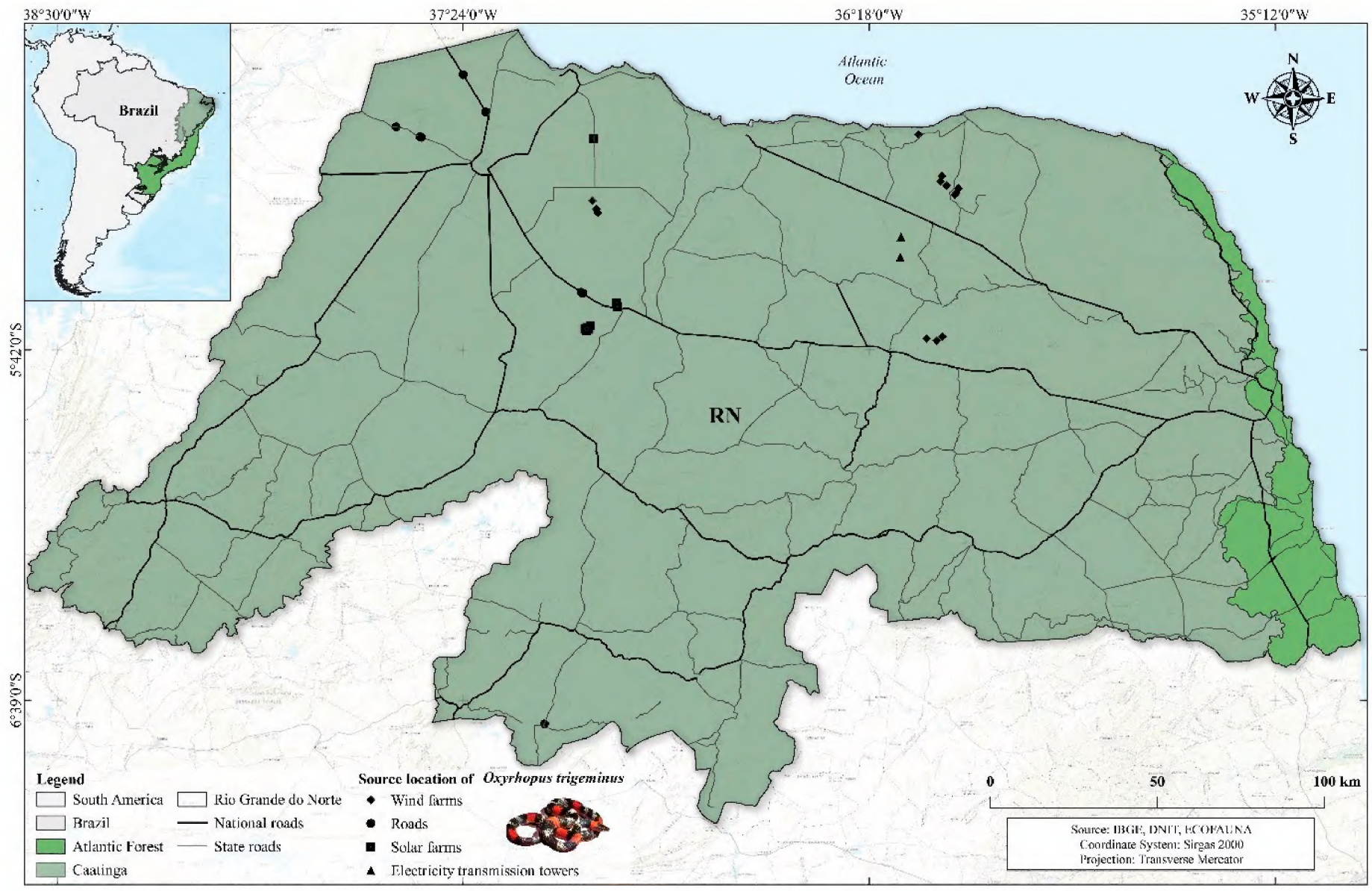

Figure 1. Sampling locations of *Oxyrhopus trigeminus* specimens from this study. Map indicating the origin points of the 48 *Oxyrhopus trigeminus* specimens tracked in the present study between 2014 and 2024. All within the Caatinga biome and in the state of Rio Grande do Norte.

Results

Literature review

Fourteen scientific studies providing information on the diet of *O. trigeminus* were identified and are listed in Table 1.

Of these, six were conducted in the Caatinga biome, three in the Atlantic Forest, three in the Cerrado, and two in transition zones encompassing more than one biome. No studies were found reporting dietary data or prey items for *O. trigeminus* populations in the Amazon or Pantanal (see Fig. 2). In both the Atlantic Forest and the Atlantic Forest–Cerrado ecotone, diet records indicate exclusive consumption of reptiles. In the Caatinga, reptiles dominate (78%), but mammals also represent a significant portion (22%). In the Cerrado, reptiles and mammals are consumed in equal proportion (50% each). The transition zone showed the highest dietary diversity, with birds, mammals, and reptiles each comprising 33.3% of the diet. Across all reviewed studies, the diet of *O. trigeminus* consisted of reptiles (Reptilia/Squamata, 70%), mammals (Mammalia, 25%), and birds (Aves, 5%) (Table 1).

Analyzed specimens

Among the 48 *O. trigeminus* specimens analyzed in the present study, 15 were identified as females (31.3%), 17 as males (35.4%), and 16 as juveniles (33.3%). The average snout-vent length (SVL), tail length (TL), and body mass

Table 1. Literature review of articles and scientific notes reporting dietary items observed for *Oxyrhopus trigeminus* in the Caatinga, Cerrado, and Atlantic Forest biomes, and an ecotone (transition zone between the Atlantic Forest, Cerrado, and Caatinga). The number of *Oxyrhopus trigeminus* analyzed in each study is provided under the column "N.".

Biome	Locality, State	N	Prey category	Food items	Reference
Caatinga	Exu/Pernambuco	9	Mammalia	*Necromys lasiurus* *.	Vitt and Vangilder (1983)
			Reptilia/Squamata	*Tropidurus torquatus*, *Ameivula ocellifera**, *Ameiva ameiva* (tail), Lizard eggs.	
Atlantic Forest	Quissamã/Rio de Janeiro	1	Reptilia/Squamata	*Tropidurus torquatus*.	Rocha et al. (2005)
Cerrado	Distrito Federal	12	Reptilia/Squamata	*Tropidurus* sp., *Ameiva ameiva*.	França et al. (2008)
			Mammalia	Unidentified mammal.	
Cerrado	Augusto de Lima/Minas Gerais	1	Mammalia	Unidentified rodent.	Pires et al. (2012)
Transition zone between the Atlantic Forest, Cerrado, and Caatinga	Minas Gerais	59	Mammalia	*Akodon* sp., *Necromys lasiurus*, *Nectomys squamipes*, *Oligoryzomys* sp., *Didelphis albiventris*,	Alencar et al. (2012)
			Reptilia/Squamata	*Tropidurus hispidus*, *Tropidurus* sp., *Hemidactylus mabouia*, *Ameiva ameiva*.	
			Ave	*Synallaxis* sp., *Coryphospingus* sp., Unidentified bird.	
Caatinga	Pentecoste/Ceará	6	Reptilia/Squamata	*Ameivula ocellifera**, *Tropidurus hispidus*, *Brasiliscincus heathi**.	Mesquita et al. (2013)
Atlantic Forest and Cerrado	Northern coast of Bahia	9	Reptilia/Squamata	*Tropidurus hygomi*, *Ameivula ocellifera*, *Oxyrhopus trigeminus*.	Marques et al. (2016)
Caatinga	Grota do Angico/Sergipe	1	Reptilia/Squamata	*Tropidurus hispidus*.	Mikalauskas et al. (2017)
Cerrado	Anápolis/Goiás	1	Reptilia/Squamata	*Micrablepharus atticolus*.	Silva et al. (2017b)
Caatinga	Ceará, Pernambuco and Paraíba	97	Reptilia/Squamata	*Vanzossaura multiscutata*, *Gymnodactylus geckoides*, *Brasiliscincus heathi*, *Ameiva ameiva*, *Tropidurus hispidus*, Unidentified lizard.	Coelho et al. (2019)
			Mammalia	*Monodelphis domestica*.	
Atlantic Forest	São João da Barra/Rio de Janeiro	1	Reptilia/Squamata	*Brasiliscincus agilis*.	Gomes Neto et al. (2020)
Caatinga	Pindaí/Bahia	1	Reptilia/Squamata	*Oxybelis aeneus*.	Coelho-Lima et al. (2020)
Caatinga	Brejinho/Pernambuco	1	Reptilia/Squamata	*Ameivula ocellifera*.	Sousa et al. (2021)
Atlantic Forest	Poções/Bahia	1	Reptilia/Squamata	*Ameiva ameiva*.	Quintana and Solé (2025)
Caatinga	The semiarid region of Rio Grande do Norte.	48	Reptilia/Squamata	*Tropidurus* sp., *Tropidurus hispidus*, *Ameivula ocellifera*, *Brasiliscincus heathi*, *Micrablepharus maximiliani*.	Present study.

* Taxonomic names in this table have been updated to reflect current standards, although original sources may use older nomenclature.

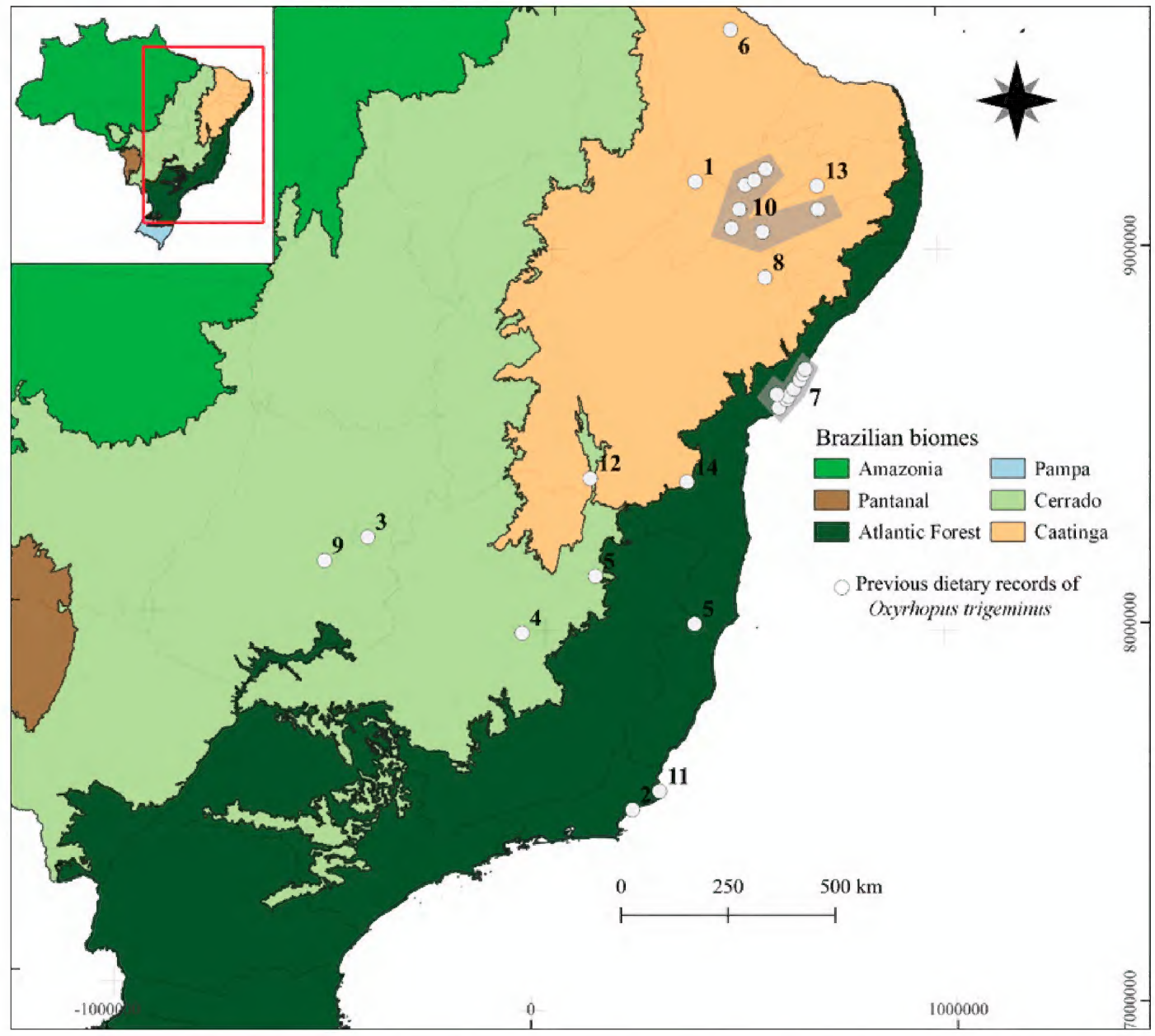

Figure 2. Sampling points from the studies included in the literature review. Map showing the sampling points of each study included in the literature review. The map includes 14 articles: point 1 corresponds to the study by Vitt and Vangilder (1983); point 2 to Rocha et al. (2005); point 3 to França et al. (2008); point 4 to Pires et al. (2012); point 5 to Alencar et al. (2012); point 6 to Mesquita et al. (2013); point 7 to Marques et al. (2016); point 8 to Mikalauskas et al. (2017); point 9 to Silva et al. (2017b); point 10 to Coelho et al. (2019); point 11 to Gomes Neto et al. (2020); point 12 to Coelho-Lima et al. (2020); point 13 to Sousa et al. (2021); and point 14 to Quintana and Solé (2025).

Table 2. Measurements of snout-vent length (SVL), tail length (TL), and body mass for female and male *Oxyrhopus trigeminus* specimens only.

	Females (N = 15)	**Males (N = 17)**
SVL (mm)	525 ± 124 (300–740)	407 ± 66 (280–550)
TL (mm)	100 ± 30.3 (60–127)	102 ± 22.1 (40–125)
Body mass (g)	65.2 ± 25.74 (14–103)	31 ± 13.16 (10–62)

for females and males are presented in Table 2. Five females with SVLs of 740, 680, 640, 628, and 595 mm each contained nine eggs.

Of the 48 *O. trigeminus* specimens analyzed, 10 (20.8%) had identifiable stomach contents. All contained lizards or lizard parts: eight specimens had whole lizards, and two had isolated tails. The identified dietary items are detailed in Table 3.

Among the lizards found were two *T. hispidus*, one *Tropidurus* sp. tail, two *A. ocellifera*, one *A. ocellifera* tail, two *Brasiliscincus heathi*, and two *Micrablepharus maximiliani*.

Table 3. Locality (municipality), sex, body mass, snout-vent length (SVL), and tail length (TL) of *Oxyrhopus trigeminus* specimens that contained identifiable dietary items or feeding traces. The table also includes the identification, SVL, and body mass of the prey items found in the stomachs. All specimens were recorded in municipalities within the state of Rio Grande do Norte, located in the semiarid region of northeastern Brazil.

Ind.	Locality	Lat/long.	Sex	Mass (g)	SVL (mm)	TL (mm)	Food items
1	Assu	5°34'33.204"S, 36°59'4.416"W	F	87	470	100	*Tropidurus hispidus*.
2	Assu	5°34'19.092"S, 36°59'8.268"W	F	31	420	90	*Ameivula ocellifera* tail in the stomach; plastic fragments, wasp, ant head, and skin and legs of Tropiduridae in the intestine.
3	Assu	5°38'25.512"S, 37°3'55.404"W	M	10	280	40	*Ameivula ocellifera*.
4	Assu	5°38'16.836"S, 37°3'50.400"W	F	78	680	119	*Tropidurus hispidus*.
5	Assu	5°37'59.772"S, 37°3'22.932"W	M	62	550	120	*Tropidurus* sp. tail in the stomach; skin, scales, and claws in the intestine.
6	Assu	5°35'0.672"S, 36°58'59.124"W	M	40	420	125	Skin, scales, and toes of *Ameivula ocellifera*.
7	Assu	5°38'31.020"S, 37°4'14.484"W	M	38	450	120	Fragments of unidentified lizard.
8	Assu	5°32'66.3"S, 37°04'74.2"W	F	68	628	124	Scales of Tropiduridae.
9	Baraúna	5°7'23.20"S, 37°30'48.70"W	F	55	539	108	Scales of Tropiduridae.
10	Caiçara do Norte	5°15'14.328"S, 36°5'24.648"W	I	6	200	50	*Brasiliscincus heathi*.
11	Caiçara do Rio do Vento	5°43'26.784"S, 36°02'03.167"W	I	9	261	63	*Brasiliscincus heathi*.
12	Caiçara do Rio do Vento	5°40'33.371"S, 36°02'03.252"W	F	103	595	119	Three lizard eggs and scales of Tropiduridae.
13	Galinhos	5°6'55.044"S, 36°9'58.680"W	M	35	430	80	*Ameivula ocellifera*.
14	Jandaíra	5°23'35.172"S, 36°12'51.071"W	F	23.6	352	101	Skin, feet, and scales of Teiidae.
15	Lajes	5°40'9.228"S, 36°8'42.828"W	I	7	215	53	*Micrablepharus maximiliani*.
16	Lajes	5°39'47.736"S, 36°6'3.924"W	F	76	740	127	Scales of Tropiduridae.
17	Lajes	5°40'9.228"S, 36°8'42.828"W	F	42	640	110	Scales of Tropiduridae.
18	Lajes	5°38'009"S, 37°06'39.9"W	I	–	–	–	Feet and scales of Tropiduridae.
19	Pedro Avelino	5°26'52.98"S, 36°12'58.4"W	I	3	160	35	*Micrablepharus maximiliani*.
20	Pedro Avelino	5°26'52.656"S, 36°12'57.996"W	M	19	380	105	Scales of Tropiduridae.
21	Serra do Mel	5°7'35.724"S, 37°2'50.964"W	I	5	230	55	Skin and scales of Teiidae.

In the intestinal content analysis, 12 specimens (25%) had identifiable prey remains. These included lizard scales, skin, limbs, and eggs from individuals belonging to the families Teiidae and Tropiduridae. One specimen contained three lizard eggs and Tropiduridae scales. Another specimen presented an unusual combination of items: a wasp, five ant heads, limbs of a Tropiduridae lizard, and a plastic fragment. The plastic fragment was identified as a 3 mm piece of blue rope composed of horizontally aligned nylon filaments undergoing disintegration. Photographic records are shown in Fig. 3.

Discussion

Literature review

No scientific studies were found reporting dietary data or prey records for *O. trigeminus* populations in the Amazon and Pantanal biomes. According to Guedes et al. (2023), the species is recorded in states that encompass portions of the Amazon biome, as well as in Mato Grosso and Mato Grosso do Sul, which include

Figure 3. Dietary items found in the gastrointestinal contents of snakes. **A** Specimen of *Oxyrhopus trigeminus* with the abdominal cavity opened, revealing a *Brasiliscincus heathi* in the stomach contents **B** *Tropidurus hispidus* **C** *Micrablepharus maximiliani* **D** *Brasiliscincus heathi* **E** plastic fragment **F** *Ameivula ocellifera*. All specimens were identified based on morphological traits. Scale bars: 1 cm (**A–D, F**); 1 mm (**E**).

areas of the Pantanal. However, despite its documented occurrence in these regions, no studies specifically addressing its diet in these biomes were found in the literature. Additionally, although no bibliographic records on the species' diet in the Pampa biome were found, it is important to note that *O. trigeminus* is not

documented as occurring in that biome. This highlights a significant knowledge gap regarding the feeding ecology of the species in these regions, especially given the ecological variation and prey availability across habitats.

The dietary composition of *O. trigeminus* varies significantly across Brazilian biomes, reflecting the species' adaptability to varying environmental conditions and prey availability. In both the Atlantic Forest and the Atlantic Forest and Cerrado ecotone, the diet is exclusively composed of reptiles (100%), indicating a strong reliance on reptilian prey in these more forested habitats. This may be attributed to the higher abundance and diversity of lizards in these regions, especially arboreal and semi-arboreal squamates.

With the exception of Alencar et al. (2012), most studies reporting the diet of *O. trigeminus* identified lizards as the most frequently consumed prey. Of the 14 published studies, eight (57.1%) included at least one specimen from the family Teiidae (*Ameiva ameiva* and *Ameivula ocellifera*), while eight (57.1%) listed at least one specimen from the family Tropiduridae, reinforcing the importance of these lizards in the species' diet.

The Caatinga biome shows a more varied dietary profile, with reptiles comprising 75% of the diet and mammals making up 25%. The greater representation of mammals in the Caatinga could be due to the more open, dry environment, where small terrestrial mammals such as rodents are more exposed and susceptible to predation. The Cerrado biome presents the most balanced dietary proportions, with reptiles and mammals each accounting for 50% of the diet. This balance may reflect the mixed vegetation structure of the Cerrado, which supports both reptilian and mammalian prey communities in relatively equal abundance. Finally, the transition zone between the Atlantic Forest, Cerrado, and Caatinga exhibits the highest trophic diversity, with equal proportions of birds (33.3%), mammals (33.3%), and reptiles (33.3%) consumed. This suggests that ecotonal environments offer a unique combination of prey resources, possibly supporting a more generalist feeding strategy in *O. trigeminus*. These findings emphasize the ecological plasticity of *O. trigeminus*, highlighting its ability to adjust foraging behavior in response to local prey availability. They also highlight the importance of habitat heterogeneity in shaping dietary patterns, reinforcing the need to consider biome-specific contexts in ecological studies of trophic dynamics.

Alencar et al. (2012) were the first to identify birds as part of the diet of *O. trigeminus*. Species such as *Synallaxis* sp. (Furnariidae) and *Coryphospingus* sp. (Thraupidae) are terrestrial birds that forage for insects and seeds on the ground (WikiAves 2024), suggesting that *O. trigeminus* primarily preys on ground-dwelling species. These findings reinforce the generalist nature of *O. trigeminus*' diet while also highlighting its predominantly terrestrial foraging strategy. Even the birds recorded as prey, which could suggest arboreal hunting behavior, are ground-foraging species, consistent with the snake's terrestrial habits. Similarly, the case of ophiophagy described by Coelho-Lima et al. (2020) follows the same ecological rationale. Although *Oxybelis aeneus* is primarily arboreal (Mesquita et al. 2013; Guedes et al. 2014), it may occasionally use the ground level during certain stages of its life cycle (Coelho-Lima et al. 2020). In fact, *O. aeneus* has been recorded among reptile species found as roadkill during long-term monitoring surveys conducted by the Laboratório de Ecologia e Conservação da Fauna Silvestre Conservation (EcoFauna), further supporting its occasional use of terrestrial substrates (Cabral 2019). The species has also

been reported among roadkill records in semiarid regions of states such as Paraíba, which borders Rio Grande do Norte (Ferreira et al. 2023), and Piauí, which, although not adjacent, also lies within the semiarid zone (Neta et al. 2023). These records suggest that, although not among the most frequently affected species, *O. aeneus* is nonetheless susceptible to threats associated with ground-level displacement in these environments.

It is worth noting that although Avila-Pires (1995) stated that a specimen of *Mabuya guaporicola* (catalog number: UMMZ 83171, deposited in the Museum of Zoology at the University of Michigan, USA) was found in the stomach of *O. trigeminus*, Harvey et al. (2008) later clarified that this specimen originated from Bolivia. Furthermore, according to the distribution proposed by Nogueira et al. (2019), the presence of *O. trigeminus* in Bolivia remains uncertain. This suggests that the recorded predation of *M. guaporicola* may have involved a congeneric snake species rather than *O. trigeminus* itself.

Analyzed specimens and feeding behavior

The frontal predation strategy of *O. trigeminus*, characterized by anteroposterior ingestion of lizards, may be associated with its rear-fanged dentition. This dentition allows venom delivery during ingestion, reducing the chances of prey escape. Conversely, posteroanterior ingestion could increase the likelihood of caudal autotomy, a common defense mechanism in lizards, ultimately decreasing resource acquisition efficiency for the predator (Vitt and Vangilder 1983). The predominance of anteroposterior ingestion, observed in *O. trigeminus*, minimizes prey escape and supports its role as an efficient lizard predator in the semiarid region.

Another factor contributing to the anteroposterior ingestion of prey by *O. trigeminus*, in addition to the natural layered arrangement of prey items, is the scale morphology of its main dietary components, such as lizards of the genus *Tropidurus*. *T. hispidus*, a relevant species among the prey items of *O. trigeminus*, has spinuate caudal scales (Vitt and Caldwell 2014), which may pose mechanical risks during swallowing and gastrointestinal transit, potentially causing abrasions or injuries to the mucosal lining of the digestive tract and death by asphyxiation (Kornilev et al. 2023). Anteroposterior ingestion may represent a behavioral adaptation that minimizes the risk of internal injuries caused by defensive structures of the prey.

Coelho-Lima et al. (2020) reported ophiophagy by *O. trigeminus*, where the same anteroposterior ingestion pattern was observed. Additionally, our study documented the presence of lizard eggs (N=3) in the intestinal contents of one specimen (2.08%), consistent with findings from Vitt and Vangilder (1983). The well-preserved condition of the calcareous shell and the size of the eggs support the interpretation that their ingestion was intentional.

The plastic fragments found in one of the analyzed intestinal contents may have originated from the digestive contents of the Tropiduridae lizards preyed upon by *O. trigeminus*, as other prey items found together (wasp and ant heads) are common dietary components of this lizard family (Kolodiuk et al. 2010; Ribeiro and Freire 2011; Oliveira et al. 2024). Alternatively, accidental ingestion by the snake when capturing its prey is another plausible explanation, though intentional ingestion should not be ruled out. This discovery highlights the increasing threat of plastic pollution, which may affect species in the semiarid

region, contributing to bioaccumulation in top predators. Similar bioaccumulative effects have been observed in reptiles exposed to heavy metals and other chemical pollutants (Burger et al. 2017; Nasri et al. 2017; Salvador et al. 2018; Quintela et al. 2024). Synthetic textile fibers are among the most abundant microplastics found in lizard diets, particularly in species inhabiting urbanized areas (Altunışık et al. 2024). *Oxyrhopus trigeminus* and *T. hispidus* are frequently found in anthropized environments (Vitt and Vangilder 1983; Mesquita et al. 2013; Andrade 2020), likely due to their greater tolerance to pollution-related threats, rather than heightened vulnerability.

Physiologically, plastic ingestion can cause gastrointestinal irritation in reptiles, promoting the proliferation of pathogenic microorganisms, the formation of ulcers, and their migration into the bloodstream, potentially resulting in septicemia, similar to cases documented in sea turtles (Poli et al. 2015; Marques et al. 2024).

Considering the lower feeding frequency of snakes compared to other animals, which frequently leads to empty stomachs in dietary studies, the inclusion of intestinal content analysis in this study demonstrates its potential as a robust methodological approach. This approach broadens the scope of investigations into snake diets and may serve as a methodological reference for future studies, contributing to a more comprehensive understanding of the feeding ecology and natural history of these predators.

Environmental changes in the Caatinga and their impact on snake ecology

The Caatinga is among the most environmentally degraded biomes in Brazil, subjected to intense pressure from agriculture, livestock expansion, and the proliferation of renewable energy projects such as wind and solar farms (Tabarelli et al. 2017; Araujo et al. 2023; Costa et al. 2024). These anthropogenic transformations have led to habitat fragmentation and altered ecological dynamics, altering predator-prey dynamics across the region (Costa et al. 2024).

Oxyrhopus trigeminus, a widespread generalist snake in Brazil, plays a key role in regulating populations of small vertebrates. In the Caatinga, our findings reaffirm that its diet is primarily composed of lizards, especially *T. hispidus* and *A. ocellifera*, two species known for their high ecological plasticity and tolerance to habitat disturbance (Mesquita et al. 2013; Andrade 2020). In fact, Albuquerque et al. (2018) demonstrated that both species thrive in human-modified environments, exhibiting consistent thermoregulatory patterns and flexible reproductive cycles across contrasting ecosystems, including urbanized and semi-natural areas. In this context, habitat degradation may not uniformly reduce prey availability for *O. trigeminus*; instead, in some areas, it may lead to an increase in populations of tolerant species such as *T. hispidus* and *A. ocellifera*, thereby favoring the persistence of generalist predators like *O. trigeminus* (Andrade 2020). However, the dominance of a few resilient prey species could lead to a simplification of food webs and reduced ecosystem resilience, including reduced capacity to recover from disturbances (Johnson 2000).

Our study also records, for the first time, the ingestion of *M. maximiliani* and reports the presence of lizard eggs in intestinal contents, corroborating earlier findings by Vitt and Vangilder (1983) and reinforcing the species' opportunistic feeding behavior. Although the presence of plastic fragments found in one

specimen does not, in itself, constitute a conservation alarm, it highlights the incorporation of anthropogenic materials into food webs, which is a growing concern in semiarid systems.

Rather than framing *O. trigeminus* as a vulnerable species in the face of environmental change, our results suggest it may serve as a biological indicator of habitat shifts, particularly in disturbed landscapes where only disturbance-tolerant prey remain. Long-term studies monitoring shifts in its diet can, therefore, contribute valuable insights into the ongoing ecological transformations of the Caatinga biome.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Data availability

All of the data that support the findings of this study are available in the main text.

References

Ab'Saber AN (1974) O domínio morfoclimático semi-árido das caatingas brasileiras. Geomorfologia 43: 1–39. https://biblio.fflch.usp.br/AbSaber_AN_1348621_ODominioMorfoclimatico.pdf

Albuquerque RL, Protázio AS, Cavalccanti LBQ, Lopez LCS, Mesquita DO (2018) Geographical Ecology of *Tropidurus hispidus* (Squamata: Tropiduridae) and *Cnemidophorus ocellifer* (Squamata: Teiidae) in a Neotropical Region: A comparison among Atlantic Forest, Caatinga, and Coastal Populations. Journal of Herpetology 52(2): 145–155. https://doi.org/10.1670/16-018

Alencar LRV, Galdino CAB, Nascimento LB (2012) Life history aspects of *Oxyrhopus trigeminus* (Serpentes: Dipsadidae) from two sites in southeastern Brazil. Journal of Herpetology 46(1): 9–13. https://doi.org/10.1670/09-219

Altunışık A, Yıldız MZ, Tatlı HH (2024) Microplastic accumulation in a lizard species: Observations from the terrestrial environments. Environmental Pollution 359. https://doi.org/10.1016/j.envpol.2024.124754

Andrade AC (2020) Metropolitan lizards? Urbanization gradient and the density of lagartixas (*Tropidurus hispidus*) in a tropical city. Ecology and Evolution 10: 1740–1750. https://doi.org/10.1002/ece3.5518

Araujo HFP, Canassa NF, Machado CCC, Tabarelli M (2023) Human disturbance is the major driver of vegetation changes in the Caatinga dry forest region. Scientific Reports 13: 9–13. https://doi.org/10.1038/s41598-023-45571-9

Avila-Pires TCS (1995) Lizards of Brazilian Amazonia (Reptilia: Squamata). Zoölogische Verhandelingen 299: 3–706. https://repositorio.museu-goeldi.br/handle/mgoeldi/1222

Boback SM (2006) A morphometric comparison of island and mainland boas (*Boa constrictor*) in Belize. Copeia 2006(2): 261–267. https://doi.org/10.1643/0045-8511(2006)6[261:AMCOIA]2.0.CO;2

Burger J, Gochfeld M, Jeitner C, Zappalorti R, Pittfield T, DeVito E (2017) Arsenic, cadmium, chromium, lead, mercury, and selenium concentrations in pine snakes (*Pituophis melanoleucus*) from the New Jersey Pine Barrens. Archives of Environmental Contamination and Toxicology 72: 586–595. https://doi.org/10.1007/s00244-017-0398-5

Cabral SO (2019) Dieta de lagartos e serpentes atropelados em rodovias do semiárido nordestino no estado do Rio Grande do Norte, RN. Master's thesis, Universidade Federal Rural do Semi-Árido, Mossoró, Brazil. https://repositorio.ufersa.edu.br/server/api/core/bitstreams/de669bf9-01ca-47e3-bf2e-486be3ac137f/content

Caldas FLS, Costa TB, Laranjeiras DO, Mesquita DO, Garda AA (2016) Herpetofauna of protected areas in the caatinga v: Seridó ecological station (Rio Grande do Norte, Brazil). Check List 12(4). https://doi.org/10.15560/12.4.1929

Calixto PO, Morato SAA (2017) Herpetofauna recorded by a fauna rescue program in a Caatinga area of João Câmara, Rio Grande do Norte, Brazil. Check List 13(5): 647–657. https://doi.org/10.15560/13.5.647

Coelho RDF, Sales RFD, Ribeiro LB (2019) Sexual dimorphism, diet, and notes on reproduction in *Oxyrhopus trigeminus* (Serpentes: Colubridae) in the semiarid Caatinga of northeastern Brazil. Phyllomedusa 18: 89–96. https://doi.org/10.11606/issn.2316-9079.v18i1p89-96

Coelho-Lima AD, Oliveira Ramos G, Martins RBX, Panelli CML (2020). Fist record of ophiophagy in the false coral snake *Oxyrhopus trigeminus* Duméril, Bibron & Duméril, 1854. Cuadernos de Herpetología 34(1): 89–91. https://doi.org/10.31017/cdh.2020.(2019-045)

Costa DP, Lentini CAD, Cunha Lima AT, Duverger SG, Vasconcelos RN, Herrmann SM, et al. (2024) All deforestation matters: Deforestation alert system for the Caatinga biome in South America's tropical dry forest. Sustainability 16: 9006. https://doi.org/10.3390/su16209006

Ferreira EL, Lima SFB, Souza JWS, Medeiros PR (2023) Wild fauna as roadkill on a highway in the semiarid region of northeastern Brazil. Ethnobiology and Conservation 12(13): 1–25. https://doi.org/10.15451/ec2023-06-12.13-1-25

França FGR, Mesquita DO, Nogueira CC, Araújo AFB (2008) Phylogeny and ecology determine morphological structure in a snake assemblage in the central Brazilian Cerrado. Copeia 1: 23–38. https://doi.org/10.1643/CH-05-034

Gomes Neto GJ, Nogueira CHO, Silveira LS (2020) Primeiro registro de predação de *Brasiliscincus agilis* (Scincomorpha: Mabuyidae) por *Oxyrhopus trigeminus* (Serpentes: Dipsadidae). Herpetologia Brasileira 9(2): 101–108. https://sbherpetologia.org.br/revista-herpetologia-brasileira

Guedes TB, Nogueira C, Marques OAV (2014) Diversity, natural history, and geographic distribution of snakes in the Caatinga, Northeastern Brazil. Zootaxa 3863(1): 1–93. https://doi.org/10.11646/zootaxa.3863.1.1

Guedes TB, Entiauspe-Neto OM, Costa HC (2023) Lista de répteis do Brasil: Atualização de 2022. Herpetologia Brasileira 12(1): 56–161. https://doi.org/10.5281/zenodo.7829013

Harvey MB, Aguayo R, Miralles A (2008) Redescription and biogeography of *Mabuya cochabambae* Dunn with comments on Bolivian congeners (Lacertilia: Scincidae) Miralles Aurélien Muséum National d'Histoire Naturelle. Zootaxa 1828: 43–56. https://doi.org/10.11646/zootaxa.1828.1.4

Johnson KH (2000) Trophic-dynamic considerations in relating species diversity to ecosystem resilience. Biological Reviews of the Cambridge Philosophical Society 75(3): 347–376. https://doi.org/10.1017/S0006323100005508

Kolodiuk MF, Ribeiro LB, Freire MEX (2010) Diet and foraging behavior of two species of *Tropidurus* (Squamata, Tropiduridae) in the Caatinga of Northeastern Brazil. South American Journal of Herpetology 5(1): 35–44. https://doi.org/10.2994/057.005.0104

Kornilev YV, Natchev ND, Lillywhite HB (2023) Perils of ingesting harmful prey by advanced snakes. Biological Reviews of the Cambridge Philosophical Society 98(1): 263–283. https://doi.org/10.1111/brv.12906

Marques R, Mebert K, Fonseca É, Rödder D, Solé M, Tinôco MS (2016) Composition and natural history notes of the coastal snake assemblage from Northern Bahia, Brazil. ZooKeys 608: 93–142. https://doi.org/10.3897/zookeys.611.9529

Marques R, Guedes TB, Lanna FM, Passos DC DA SILVA WP, Garda AA (2021) Species richness and distribution patterns of the snake fauna of Rio Grande do Norte State, Northeastern Brazil. Anais Da Academia Brasileira de Ciências 93. https://doi.org/10.1590/0001-3765202120191265

Marques RDP, Bezerra TCS, Fossá MVA, Araujo IO (2024) Gastrointestinal impaction in a juvenile green turtle (*Chelonia mydas*) due to ingestion of solid waste: Case report. Medicina Veterinaria (Brazil) 18(3): 188–194. https://doi.org/10.26605/medvet-v18n3-6744

Martins M, Oliveira ME (1998) Natural history of snakes in forests of the Manaus region, Central Amazonia, Brazil. Herpetological Natural History 6(2): 78–150.

Mesquita PCMD, Passos DC, Borges-Nojosa DM, Cechin SZ (2013) Ecologia e história natural das serpentes de uma área de Caatinga no nordeste brasileiro. Papéis Avulsos de Zoologia 53: 99–113. https://doi.org/10.1590/S0031-10492013000800001

Mikalauskas JS, Santana DO, Ferrari SF (2017) Lizard predation *Tropidurus hispidus* (Squamata, Tropiduridae) by false coral snake *Oxyrhopus trigeminus* (Squamata, Dipsadidae) in the Caatinga, in northeastern Brazil. Ciências Exatas e Da Natureza 1: 60–67. https://doi.org/10.29215/pecen.v1i1.174

Nasri I, Hammouda A, Hamza F, Zrig A, Selmi S (2017) Heavy metal accumulation in lizards living near a phosphate treatment plant: Possible transfer of contaminants from aquatic to terrestrial food webs. Environmental Science and Pollution Research International 24: 12009–12014. https://doi.org/10.1007/s11356-015-5390-x

Neta CSS, Abra FD, Santos LB, Costa EPL, Diniz MF, Morato RG (2023) Identificação de áreas críticas de atropelamento de fauna na região do Parque Nacional da Serra da Capivara, Piauí. Biodiversidade Brasileira 13(4): 1–18. https://doi.org/10.37002/biodiversidadebrasileira.v13i4.2412

Nogueira CC, Argôlo AJS, Arzamendia V, Azevedo JA, Barbo FE, Bérnils RS, et al. (2019) Atlas of Brazilian snakes: Verified point-locality maps to mitigate the Wallacean shortfall in a megadiverse snake fauna. South American Journal of Herpetology 14: 1–274. https://doi.org/10.2994/SAJH-D-19-00120.1

Oliveira PMA, Feitosa JLL, Nunes PMS (2024) Seasonal influence on the feeding patterns of three sympatric *Tropidurus* lizards (Squamata: Tropiduridae) of the Caatinga, in the Brazilian Semi-Arid Region. South American Journal of Herpetology 31: 56–64. https://doi.org/10.2994/SAJH-D-21-00043.1

Pires RC, Borges VS, Souza AM, Eterovick PC (2012) Natural history of a snake assemblage alongside a river in southeastern Brazil. Journal of Natural History 46: 369–381. https://doi.org/10.1080/00222933.2011.641603

Poli C, Mesquita DO, Saska C, Mascarenhas R (2015) Plastic ingestion by sea turtles in Paraíba State, Northeast Brazil. Iheringia. Série Zoologia 105: 265–270. https://doi.org/10.1590/1678-476620151053265270

Quintana PD, Solé M (2025) Unsuccessful predation of *Ameiva ameiva* (Linnaeus, 1758) causes the death of a juvenile snake, *Oxyrhopus trigeminus* Duméril et al., 1854, in Bahia, northeastern Brazil. Herpetology Notes 18: 25–27. https://www.biotaxa.org/hn/article/view/85439

Quintela FM, Costa PG, Bianchini A (2024) Arsenic and metal levels in snake tissues from Lagoa Santa Karst, Brazil. Environmental Science and Pollution Research International 31: 50243–50260. https://doi.org/10.1007/s11356-024-34518-w

Ribeiro LB, Freire EMX (2011) Trophic ecology and foraging behavior of *Tropidurus hispidus* and *Tropidurus semitaeniatus* (Squamata, Tropiduridae) in a caatinga area of northeastern Brazil. Iheringia. Série Zoologia 101(3): 225–232. https://doi.org/10.1590/S0073-47212011000200010

Rocha CFD, Bergallo HG, Hatano FH, Sluys MV (2005) *Oxyrhopus trigeminus* (false coral snake): Prey. Herpetological Review 36(4): 458–459.

Rodrigues MT (2003) Herpetofauna da Caatinga. In: Leal IR, Tabarelli M, Silva JMC (Eds) Ecologia e conservação da Caatinga. University Press of the Federal University of Pernambuco, Recife, 181–236. https://www.gov.br/mma/pt-br/assuntos/biodiversidade-e-biomas/biomas-e-ecossistemas/biomas/arquivos-biomas/5_livro_ecologia_e_conservao_da_caatinga_203.pdf

Salvador RMV, Pim F, Júnior HAN, Abreu AT, Pimentel EF, Cerqueira LO, et al. (2018) *Tropidurus torquatus* (Squamata: Tropiduridae) as a bioindicator of heavy metal (aluminum and zinc) pollution in Vila Velha, Brazil. Environmental Science and Pollution Research International 25: 1210–1219. https://doi.org/10.1007/s11356-017-0427-y

Shine R, Webb JK, Fitzgerald M, Sumner J (1998) The impact of bush-rock removal on an endangered snake species, *Hoplocephalus bungaroides* (Serpentes: Elapidae). Wildlife Research 25(3): 285–295. https://doi.org/10.1071/WR97022

Silva JMC, Barbosa LCF, Leal IR, Tabarelli M (2017a) The Caatinga: Understanding the Challenges. In: Silva JMC, Leal IR, Tabarelli M (Eds) Caatinga: The largest Tropical Dry Forest region in South America. Springer, Cham, 3–19. https://doi.org/10.1007/978-3-319-68339-3_1

Silva JR, Ramalho WP, Arruda FV, De-Carvalho CB, Prado VHM (2017b) *Micrablepharus atticolus*. Predation. Herpetological Review 48(3): 652. https://ssarherps.org/herpetological-review-pdfs/

Sousa JD, Mariano EF, Barbosa CJS, Medeiros JVA, Kokubum MNC (2021) New records of predators of *Ameivula ocellifera* (Squamata: Teiidae), with an emphasis on predation by Birds. Phyllomedusa 20(2): 197–202. https://doi.org/10.11606/issn.2316-9079.v20i2p197-202

Tabarelli M, Leal IR, Scarano FR, Silva JMC (2017) The future of the Caatinga. In: Silva JMC, Leal IR, Tabarelli M (Eds) Caatinga: The largest Tropical Dry Forest region in South America. Springer, Cham, 461–474. https://doi.org/10.1007/978-3-319-68339-3_19

Vanzolini PE, Vitt LJ, Ramos-Costa AMM (1980) Répteis das Caatingas. Academia Brasileira de Ciências, Rio de Janeiro, 208 pp. https://doi.org/10.5962/bhl.title.109659

Vitt LJ, Caldwell JP (2014) Herpetology: an introductory biology of amphibians and reptiles. Academic Press is an Imprint of Elsevier, Oxford, 757 pp. https://doi.org/10.1016/B978-0-12-386919-7.00002-2

Vitt LJ, Vangilder LD (1983) Ecology of a snake community in Northeastern Brazil. Amphibia-Reptilia 4: 273–296. https://doi.org/10.1163/156853883X00148

WikiAves (2024) A Enciclopédia das Aves do Brasil. http://www.wikiaves.com.br/ [Accessed on 21 november 2024]